

OBJECTIVE: To help students become aware of different factors influencing cropland soil management decisions and to help them understand different soil erosion control techniques.

The Farm Management Game (S, LA, SS, M)

Materials: copies of the student information sheet (pages 14-15), one die, and calculators (optional)

In this simulation game, your students will make soil conservation management decisions for a 480 acre farm over a five-year period. Make sure that they are familiar with basic cropland soil conservation practices.

★ **Background Information.** The farm is divided into three different sections according to topography (see diagram on student work sheet). The farm is located in a temperate zone in the United States. The area gets an average annual precipitation of thirty-five inches and the growing season lasts from May to September. High winds typically start in January and last through April. The area is subject to major weather changes from year to year.

The soil on the farm is rich in organic material making it good cropland, but it is also moderately to highly erodible. The land has been used as cropland since 1910. No soil conservation measures have been used by previous owners, and the topsoil has become extremely shallow in some areas. Corn, or some other row crop, is grown every year.

The object of the game is for the students to be wise land managers. They should make as much money as they can (since farming is a business), while protecting their precious soil resources. The Soil Conservation Service has estimated that an annual soil loss of five tons per acre represents the maximum amount of soil that can be lost from the land without a long-term loss

in productivity. The students will be penalized for every ton/acre of soil loss that exceeds this yearly 5 ton/acre limit in each section.

★ Playing the Game

1. Divide your class into groups and give each a copy of the student information sheet. Discuss the soil conservation techniques.
2. Share the background information with your class. Each group will be a farm management team, responsible for making land-use decisions for the next five years. Students should consider —
 - a) the physical characteristics of each section of the farm;
 - b) the present rate of soil erosion from each section; and
 - c) the costs and/or benefits of each management practice.
 The three sections of the farm should be treated separately.
3. Give each group time to decide which conservation practices they want to use. The students should decide on one of the tillage options listed on the information sheet for each section..
4. Have the students roll the die to determine the weather conditions for the first year.
5. Have the students determine the results of their decisions by looking at the appropriate sections of the Result Chart. For instance, if one group decided to use conservation tillage option #6 (**no-till**) for the eastern section, #3 (contour plowing) for the central section, and #7 (no-till and contouring) for the western section, and the number on the die was a "3," then the results would be:

East Section:

Net Profit = \$12,000
Soil Loss = 3.5 tons/acre

Central Section:

Net Profit = \$12,000
Soil Loss = 12 tons/acre

West Section:

Net Profit = \$6,500
Soil Loss = 7 tons/acre

6. Have students total profits and soil losses for each section. Give the students a few minutes to de-

cide on their management practices for the next year.

7. Repeat until the students have managed their land for five years. Keep a running total of profit and soil losses for each section.
8. Analyze and compare results as follows:
 - a) Calculate total profit for the five-year period.
 - b) Calculate the total soil loss (in tons/acre) from each section during the five-year period.
 - c) For each section, subtract \$250 from the total profit for every ton/acre of soil loss exceeding 25 tons/acre. For example, if the total soil loss is 40 tons/acre in the central section, then deduct $15 \times \$250 = \$3,750$ from the total profit. Repeat for the other two sections if the soil loss is greater than 25 tons/acre. This shows that the loss of soil over a period of time can lead to a reduction in yields, which leads to a reduction in profits.
 - d) Each group must make at least \$100,000 total net profit to be able to successfully manage and keep its farm.
 - e) To help your students understand soil loss, explain that five tons of topsoil spread out over an acre is as thick as one dime. About 150 tons of topsoil spread over an acre would be one inch deep. Calculate the depth of soil lost from each section. (Divide total soil loss in each section by 150 tons/acre to calculate inches lost.) If the soil loss from each section continues at the same rate, how much topsoil would be left in each section in fifty years? One hundred years?
 - f) Discuss the long- and short-term effects of their decisions. What considerations are important in cropland management and in environmental management? How can we balance the need for soil conservation with the economic requirements of farming?

The Farm Management Game

Student Information Sheet

Result Chart

Result Chart		Conservation Tillage Options																	
		1		2		3		4		5		6		7		8			
Outcomes	None	Winter Cover		Contour Plowing		Contour Plow and Winter Cover		Terraces and Contour Plow		No-Till		No-Till and Contouring		Retire from Cultivation		Five Year Limits			
		Net Profit (\$) (NP)	Soil Loss (tons/acre) (SL)	NP	SL	NP	SL	NP	SL	NP	SL	NP	SL	NP	SL	NP	SL	Minimum Net Profit	Maximum Soil Loss
Roll the die and if:																			
East Section																			
1 or 2: Optimal Conditions		18,000	5	16,500	3.5	17,500	3	16,000	2	—	—	15,000	1.5	14,500	1	0	0	\$100,000	25 tons/acre (—\$250 for every ton/acre over this limit for each section)
3 or 4: Average Year		15,000	10	13,500	7.5	14,500	6	13,000	4.5	—	—	12,000	3.5	11,500	2	0	0.5		
5 or 6: Adverse Conditions		10,000	15	8,500	9.5	9,500	7.5	8,000	5.5	—	—	8,000	4.5	7,500	2.5	0	1		
Central Section																			
1 or 2: Optimal Conditions		15,000	12	13,500	9	14,500	7	13,000	5.5	10,000	3	12,000	4	11,500	2.5	0	0.5	\$100,000	25 tons/acre (—\$250 for every ton/acre over this limit for each section)
3 or 4: Average Year		12,500	20	11,000	15	12,000	12	10,500	9	8,000	5	9,500	7	9,000	4	0	1		
5 or 6: Adverse Conditions		8,000	30	6,500	20	7,500	16	6,000	12	4,500	6.5	6,000	9	5,500	5	0	1.5		
West Section																			
1 or 2: Optimal Conditions		12,000	25	10,500	18.5	11,500	15	10,000	11	6,000	6	9,000	8.5	8,500	5	0	1.5	\$100,000	25 tons/acre (—\$250 for every ton/acre over this limit for each section)
3 or 4: Average Year		10,000	35	8,500	26	9,500	21	8,000	15.5	4,500	10	7,000	12	6,500	7	0	2		
5 or 6: Adverse Conditions		6,000	50	4,500	36	5,500	29	4,000	21	2,500	11.5	4,000	16	3,500	9.5	0	3		

\$100,000
25 tons/acre (—\$250 for every ton/acre over this limit for each section)

Explanations of Tillage Options

1. **No conservation tillage:** conventional tillage with a plow, using straight rows running the entire length of the field.
2. **Winter cover:** Grassy or leguminous vegetation (i.e. clover) planted on a crop field to reduce erosion in the winter.

3. **Contour plowing:** plowing across a slope (along the contour) instead of up and down it, so as to slow down water runoff.
4. **Contour plowing and winter cover:** a combination of 2 and 3.
5. **Terraces:** ridges or steps built on a slope to slow down runoff.
6. **No-till:** planting directly among the stubble left from last year's crop. The soil is left undisturbed.

7. **No-till and contouring:** a combination of 3 and 6, except crops are planted in rows along the contour without plowing.
8. If a cropland is subject to severe erosion, it can be **retired from cultivation** (either temporarily or permanently) and left in cover to reduce erosion.

Descriptions of Farm Plots

West Section	Central Section	East Section
<ul style="list-style-type: none">steep terrain (9-14% slope)highly erodible soilgullies are forming over much of the areaaverage annual soil loss is 35 tons/acreonly 8 inches of topsoil remain	<ul style="list-style-type: none">moderate slopes (5-9%)moderate to highly erodible soilaverage annual soil loss is 20 tons/acreonly 10 inches of topsoil remain	<ul style="list-style-type: none">relatively flat bottomland (2-5% slope)moderately erodible soilaverage annual soil loss is 10 tons/acre18 inches of topsoil remain



Score Sheet

Section	Year					Totals
	1	2	3	4	5	
EAST	Net Profit					
	Soil Loss (tons/acres)					
CENTRAL	Net Profit					
	Soil Loss (tons/acres)					
WEST	Net Profit					
	Soil Loss (tons/acres)					

